XMSF

Extensible Modeling and Simulation Framework

Overview

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An Employee-Owned Company

Old Dominion University

Presentation Overview

- What and why is XMSF?
- Early successes
- Expanding the scope of XMSF
- Proof-of-concept / scale-up

XMSF Activities

Web-based M&S community development

Commercial standards liaison :

Web3D, SISO, OGC, OMG, IETF

Exemplar technology projects

Defense M&S relevance problems

Current approaches are not compatible with effective use of emerging Web technologies

Military modeling & simulation has little or no apparent impact on warfighters' daily tactical operations

Diverse simulations do not scalably interoperate with warfighting systems

Global systems are not yet possible without connection to common interoperable framework

- Numerous physical and logical "stovepipes" prevent this

Motivation

Transformational technologies are needed to scale up defense modeling/simulation to meet real-world needs

Web technologies provide a common framework:

- Dynamic capabilities, open standards, Web business model provide lift to support government and commercial success
- Easy use and open extensibility for developers and users, fueling rapid growth of interoperable simulations
- Bring defense modeling/simulation/tactical support into mainstream of enterprise-wide best-business practices

XMSF precepts

Web-based technologies can provide an extensible modeling and simulation architecture, to support a new generation of interoperable applications

Simulation support is needed for operational warfighting capabilities

XML-based architecture can provide a bridge between emerging rehearsal/reality/replay requirements and open/commercial Web standards

Particularly promising for C4I-Simulation interoperation

Web = best tech strategy + best business case

XMSF Definition

The Extensible Modeling and Simulation Framework (XMSF) is defined as a set of Web-based technologies and services, applied within an extensible framework, that enables a new generation of modeling & simulation (M&S) applications to emerge, develop and interoperate.

Current work in Web Services appears to be an appropriate basis for organizing and composing the many necessary capabilities of Web/XML and Internet/networking needed for M&S applications.

What Does XMSF "Look Like?"

A set of profiles rather than a single architecture

- Formal technical specifications for interoperability of web based technologies in support of modeling and simulation
- A profile may define a new capability or define interoperability between two or more existing capabilities

XMSF profiles will include

- Applicable Web technologies, protocol standards, data and metadata standards
- A tailoring of the set of selected standards
- Recommendations and guidelines for implementation

XMSF History

XMSF partnership started Spring 2002.

Secured startup funding from DMSO and held a series of meetings to validate that viewpoint in the M&S community:

- Invitational Workshop at NPS, Aug 02, focused expert efforts
- Open Symposium at GMU, Sep 02, strong community support
- Technical report Oct 02 (see http://movesinstitute.org/xmsf)
- Early adopter workshop SAIC, McLean Virginia, Feb 03
- JFCOM workshop ODU, Suffolk Virginia, May 03
- Demonstrations I/ITSEC, Orlando Florida Dec 02 and 03

Results reported at Simulation Interoperability Workshop (SIW) and other conferences in 2003.

- Goal: get the M&S community involved.
- It is working!

XMSF Leadership Challenge

- Develop a coordinated DoD approach to applying commercial Web standards for interoperable M&S
  - Supported by commercial investment wherever possible
- Recognize and take advantage of legacy technology
  - But recognize it is a sunk cost
  - To be exploited, not honored just because it exists
- Maintain involvement in key commercial standards so DoD gets needed capabilities
  - Pay for what is needed while leveraging OPM
    - Other people's money!

Web Services

Repositories Where approved services reside	**Administrative** Exemplar: DoD XML Registry
Services Discovery Publish, search capabilities	**UDDI, LDAP** Universal Description, Discovery Integration Lightweight Directory Access Protocol
Services Description Detailed methods, parameters	**WSDL, BPEL4WS** Web Services Description Language Business Process Execution Language for Web Services
XML Messaging Simple XML encoding/decoding	**XML-RPC, SOAP, XMLP** Remote Procedure Calls, XML Protocol
Service Transport Move messages between apps	**HTTP, SMTP, FTP, BEEP** Transfer is independent of messages

Early Successes

Extensible 3D Graphics (NPS)

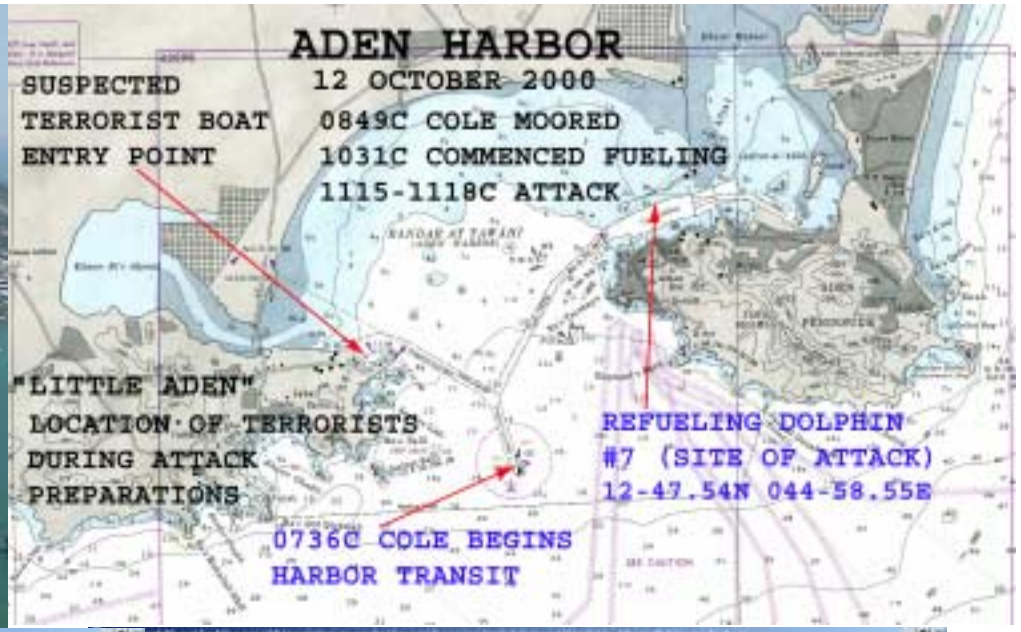
X3D brings the power of XML to 3D visualization

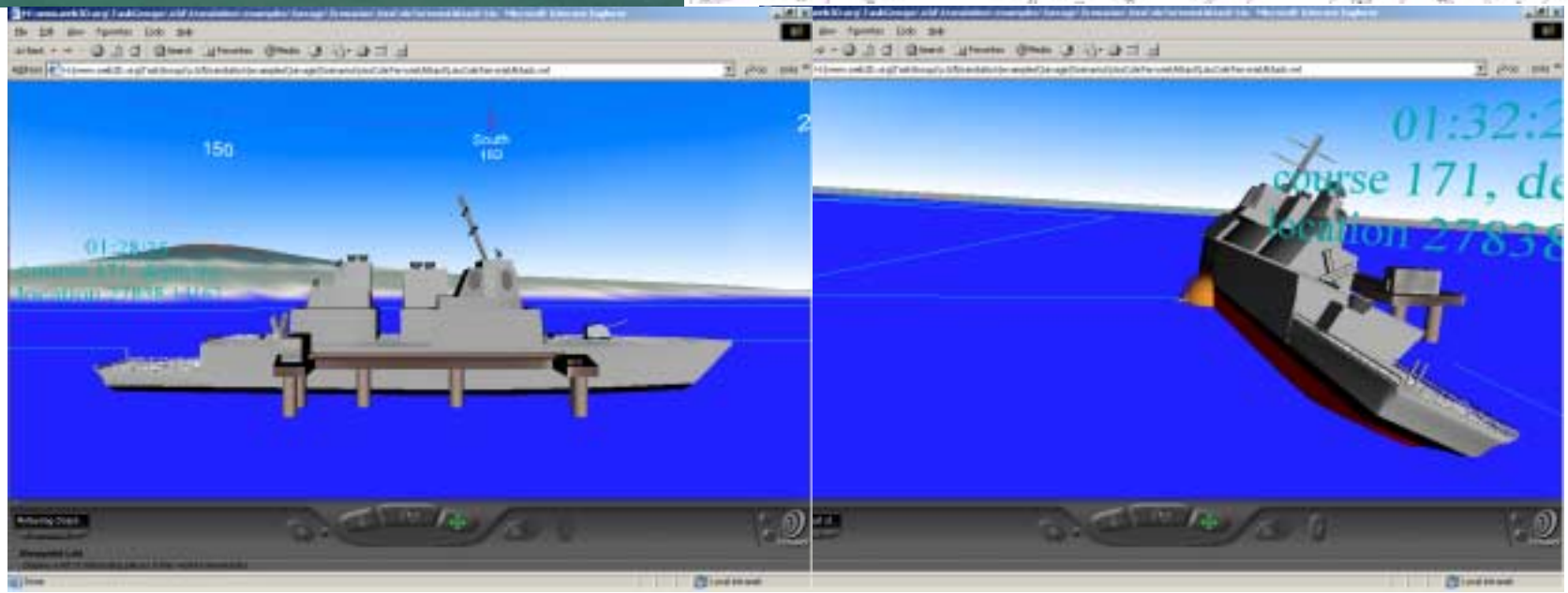
Agreed ISO Draft International Standard June 03

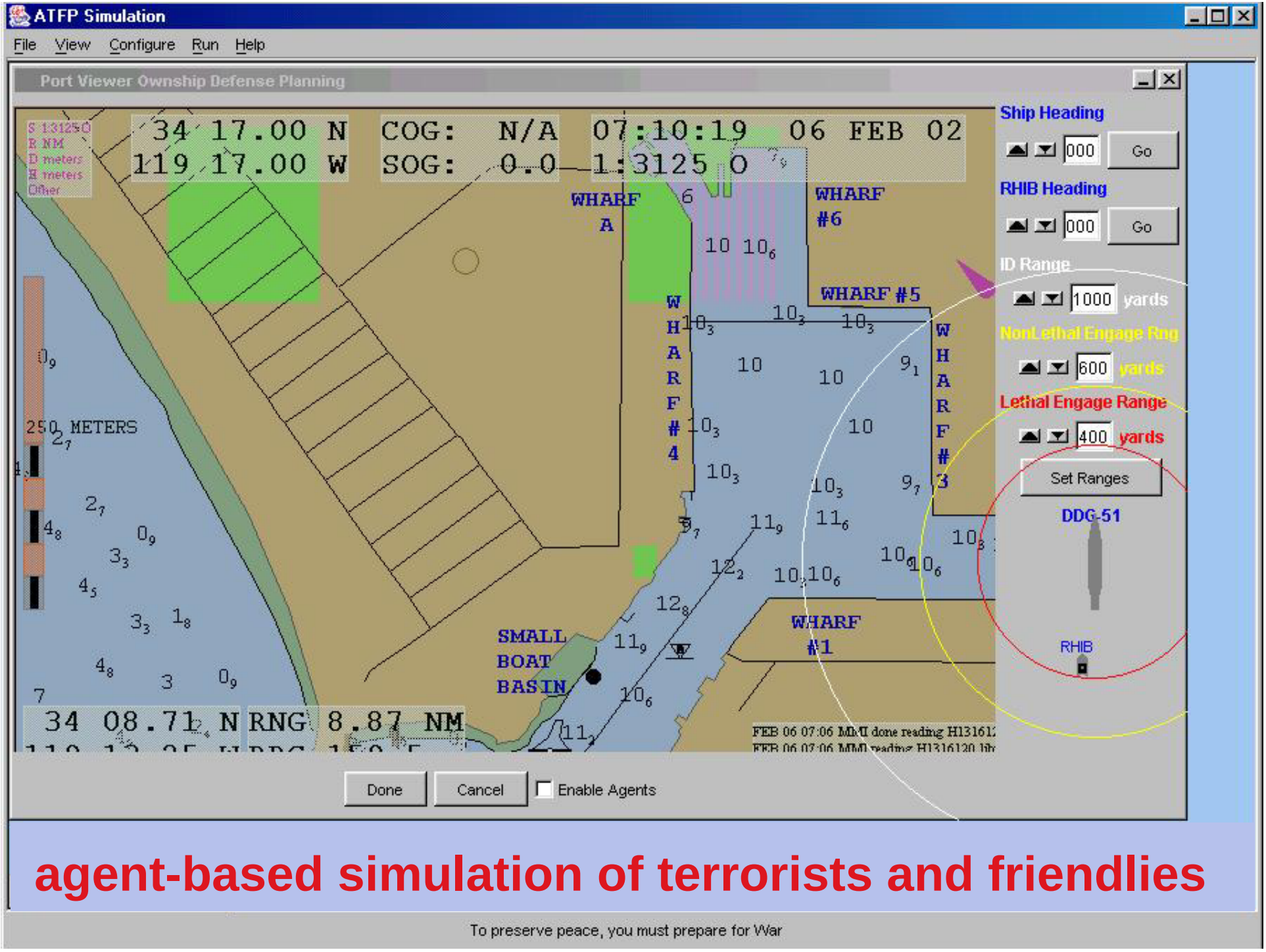
Software Development Kit (SDK) available
http://www.web3d.org/x3d

Progress, new releases of open source X3D browsers ongoing

Visualizing Al Queda USS COLE attack






ATFP Simulation
File View Configure Run Help
Port Viewer Ownship Defense Planning
34 17.00 N COG: N/A 07:10:19 06 FEB 02
119 17.00 W SOG: 0.0 1:3125 0
WHARF A
WHARF #6
WHARF #5
WHARF #4
WHARF #3
WHARF #1
SMALL BOAT BASIN
250 METERS
34 08.71 N RNG 8.87 NM
Ship Heading
000
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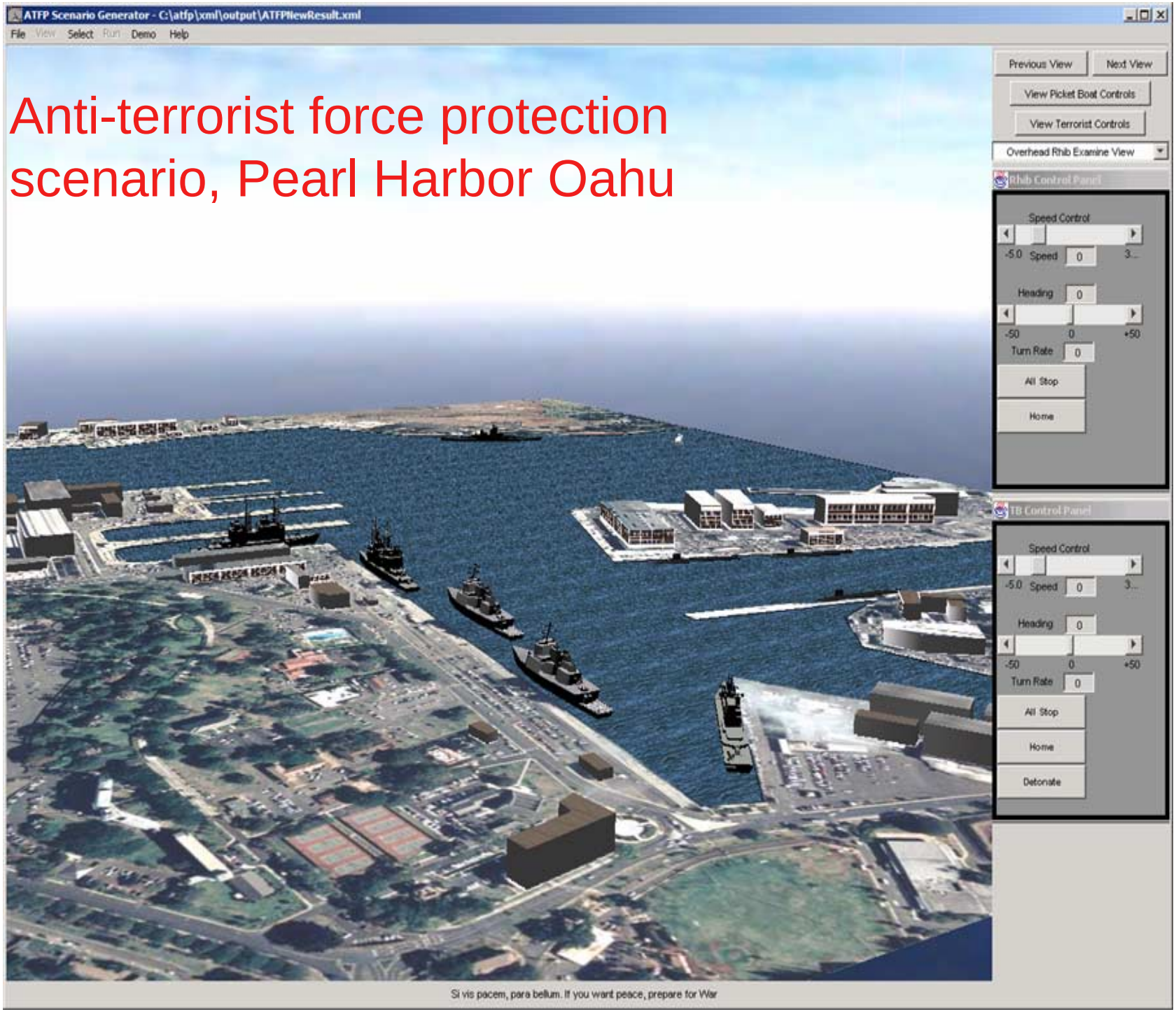
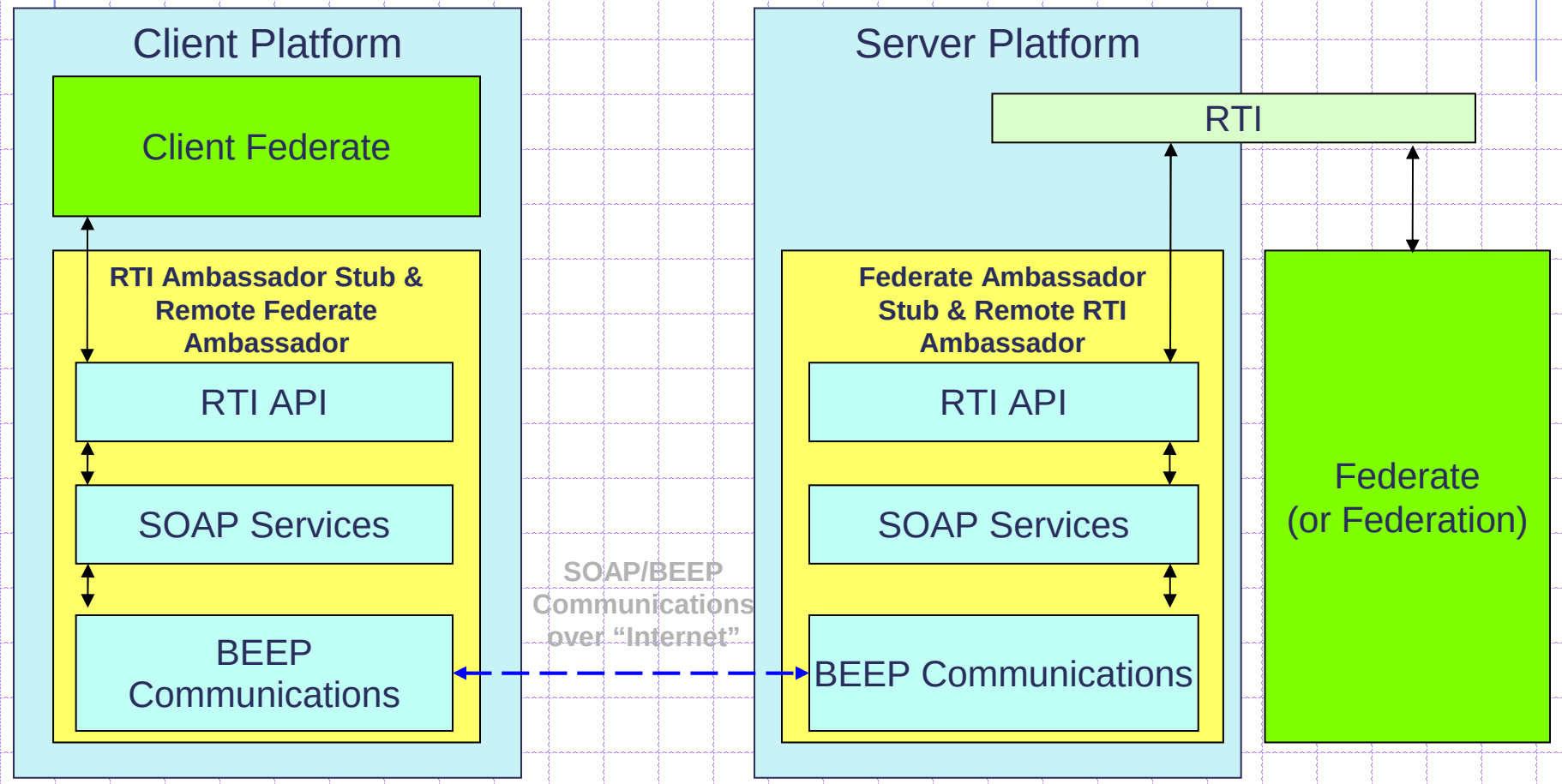
ID Range
1000 yards
NonLethal Engage Rng
600 yards
Lethal Engage Range
400 yards
Set Ranges
DDG-51
RHIB
Done
Cancel
Enable Agents
agent-based simulation of terrorists and friendlies
To preserve peace, you must prepare for War


ATFP Scenario Generator - C:\atfp\xml\output\ATFPNewResult.xml
File View Select Run Demo Help
Anti-terrorist force protection scenario, Pearl Harbor Oahu
Previous View
Next View
View Picket Boat Controls
View Terrorist Controls
Overhead Rhib Examine View
Rhib Control Panel
Speed Control
-5.0 Speed 0 3...
Heading 0
-50 0 +50
Turn Rate 0
All Stop
Home
TB Control Panel
Speed Control
-5.0 Speed 0 3...
Heading 0
-50 0 +50
Turn Rate 0
All Stop
Home
Detonate
Si vis pacem, para bellum. If you want peace, prepare for War

Web Enabled RTI as a Web Service (SAIC)

- HLA federations using XMSF compliant web Services for communication between federates
- Federates callable as web services
  - SOAP formatted RTI calls using BEEP communications
  - HLA specification compliant (DMSO RTI)
  - Bi-directional calls allow call backs to remote federates
- Demonstrated in three federations
  - HPAC and ITEM in DTRA's WMDOA federation
  - Circuit building exercise in HLA-ADL integrated instruction
  - XMSF DCEE Viewer (XDV)

Web Enabled RTI Communication Architecture

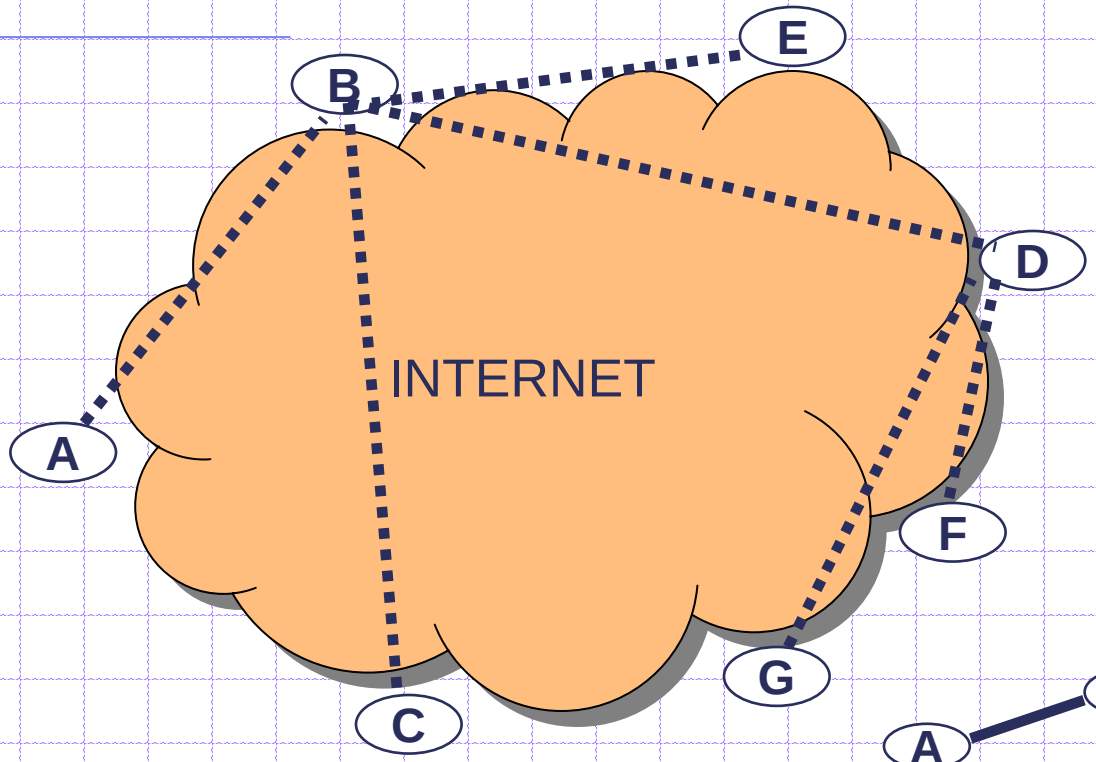


XMSF Overlay Multicasting (GMU)

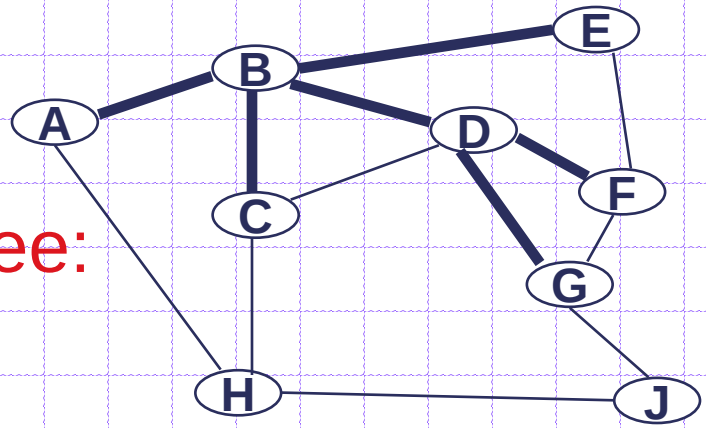
August '02 Monterey workshop identified many-to-many multicasting with Quality of Service as a significant technology gap for Web-enabled M&S

- And overlay multicast as a solution
- Approach emerging at CMU, MIT
  - M&S complication: many-to-many traffic
- Approach allows relative Quality of Service
- Pre-prototype GMU/NPS student project demonstrated potential for M&S use
  - Full prototype development now underway

Overlay Multicast Tree



IP Multicast tree:

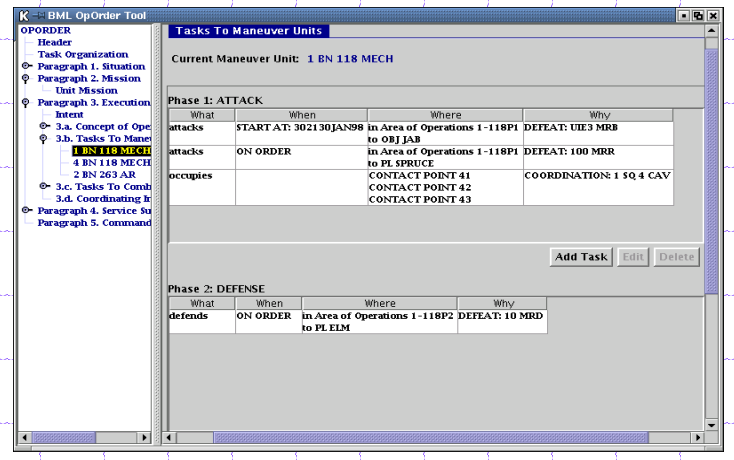


Extensible Battle Management Language (GMU-ODU-ACS-Alion)

- Focus: C4I-Simulation Interoperability
- DMSO-funded project to transfer very promising Army Battle Management Language (BML) to open Web standards
  - Spearhead: Dr. Mike Hieb of Alion
- Expanding to Joint/Combined arena with C2IEDM
  - Moving force: Dr. Andreas Tolk of ODU
- ACS converted Army BML to XBML Web services in three months
  - Demonstrated at I/ITSEC'03

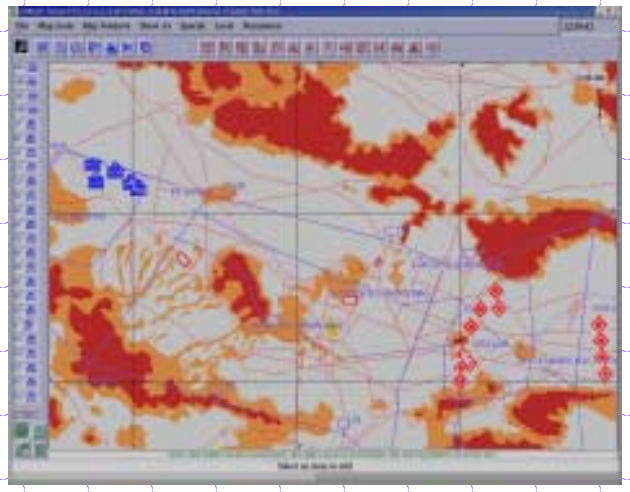
XBML

BML GUI commander's orders



XML/ SOAP

OTB simulation



XML/ SOAP

Multi Source Database

XML/ SOAP

CAPES Army C4I

XMSF DCEE Viewer (XDV) (GD/AIS-ODU-SAIC-NPS)

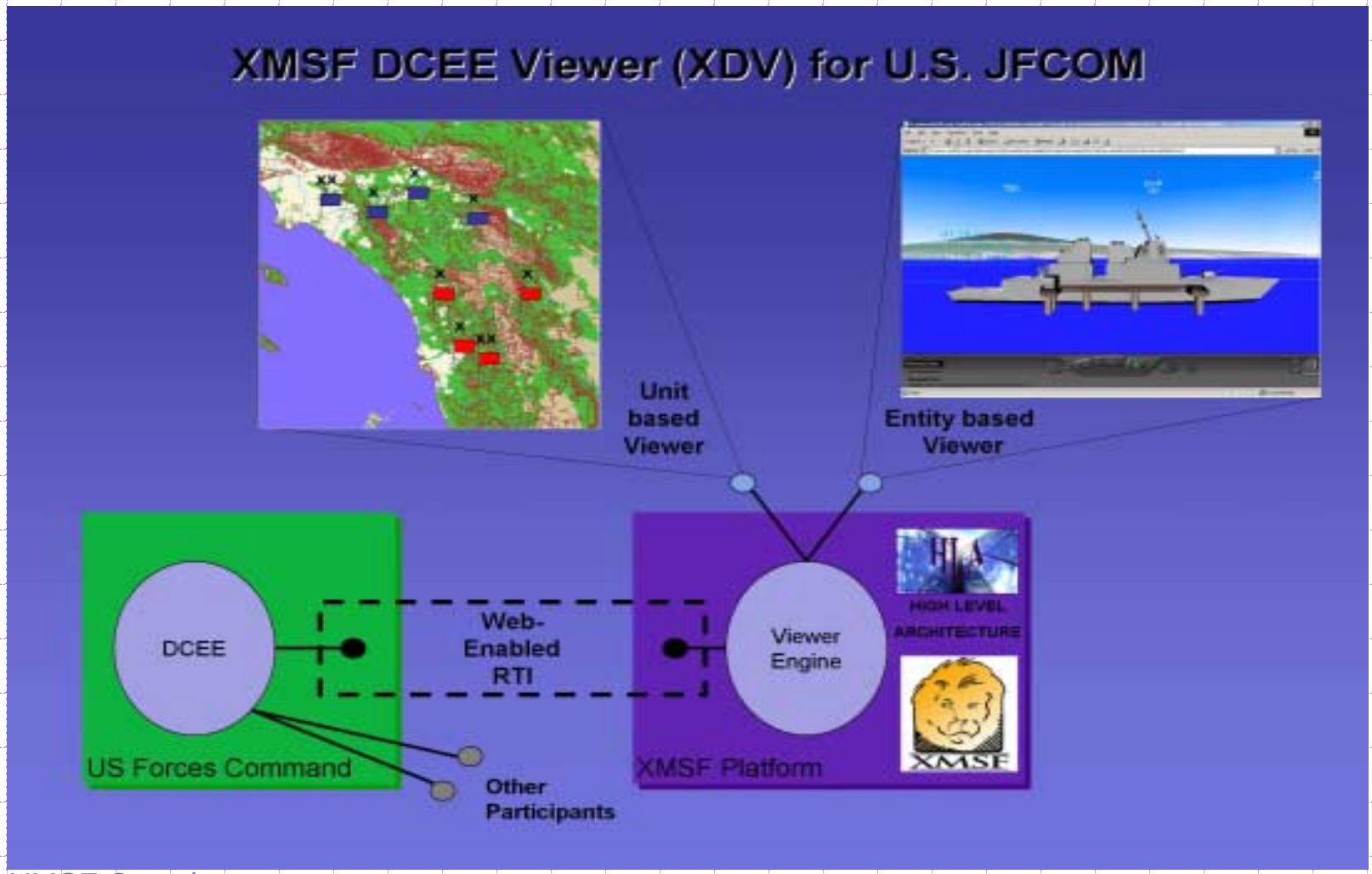
Open standards-based Viewer for the Distributed Continuous Experimentation Environment (DCEE)

Sponsor: U.S. Joint Forces Command Experimentation Directorate (JFCOM/J9)

Six-week project completed Summer 2003

- Proof-of-principle prototype runs on Commercial-off-the-Shelf PCs
- Uses web-based protocols to display the actual situation within the DCEE federation
- Can be used by eligible DCEE users wherever Internet is available
- Comprised of Web-Enabled RTI with an Entity Based Viewer and a Unit Based Viewer

XDV Architecture



Expanding the Scope of XMSF

WebSim Symposium Oct 03

Goal: establish national, global technical agenda for standards-based simulation on the Web

- Open GIS Consortium (OGC)
- Simulation Interoperability Standards Org. (SISO)
- Web3D Consortium
- Object Management Group (OMG)

- Came together and learned how much we have in common
- Highlight: Dawn Meyerreicks, CTO DISA
  - Web services are the path the C4I interoperation

Commercial Industry Participation

- Sun Microsystems providing Web services support to NPS
  - Terrain server, services
  - SAVAGE 3D Models Archive
  - WSDL, registries, varied architectural activities
  - User context via Common Access Card, mobile
- Microsoft has expressed interest
- Industry sees XMSF endeavors as likely to become broad, common activity
- Understanding needs of government users, applications and lifecycles is critical to them

Simulation, C4I, and the GIG

DISA, the leading C4I element of DoD, has undertaken a major new initiative called the Global Information Grid (GIG)

- High-capacity network access worldwide
- Network-Centric Enterprise Services: software that is broadly available in the GIG
- Community of Interest (COI) as an organizing principle
  - Each COI has an associated NameSpace that defines a basis for information exchange
- Web services provide application-level information exchange

Standards Activities

- XMSF is based in commercial standards
  - Although some military standards also apply
  - e.g., C2IEDM
- DoD can influence but not dictate to
  - World Wide Web Consortium (W3C)
  - Web3D Consortium
  - Object Management Group (OMG)
  - Open GIS Consortium (OGC)
  - Internet Engineering Task Force (IETF)
- SISO provides path to keep the DoD M&S community up to date on commercial standards developments
  - XMSF profiles synchronize their use
  - http://www.sisostds.org

Proof-of-Concept / Scale-up

XBML Phase II

- Deploying a usable XBML based on the NATO Command and Control Information Exchange Data Model (C2IEDM)
- Coordinated effort
  - DMSO funded GMU-ODU-ACS-Alion project
  - Army BML deployment using XMSF approach
  - JFCOM funding Air Battle Order ODU-Gestalt
  - Allies interested in participation: UK, France, Australia
- Goal in sight: unambiguous language enables C4I-Simulation interoperation

Experimentation C2 Interface (XC2I)

- Concept derived from XDV proof of principle
  - ODU, SAIC, GMU working with GD to implement
- Internet-deployable viewer-controller for experiments and exercises
  - Supports participation remote from simulation
- Web services provide network linkage
  - Aggregation Interest Management
  - Area of Interest Management
  - Role-based access control
- Overlay multicast option for network efficiency

Next Steps

Near term

- Complete profile standard
- Continue expansion in the M&S community
- Cement relationship with the C4I community

Mid term

- Institutionalize communicating progress, capturing results, and disseminating profiles
  - Archive of results
  - Identify process for standardizing best practices

(Who certifies that a profile or product is “XMSF Compliant?”)

Summary

Web-based technologies and techniques can provide an extensible modeling and simulation framework

- Support a new generation of interoperable applications
- Integrate/reuse existing M&S technologies

Open standards preserve stakeholders' past investment and protect against the future risk of proprietary technologies

XMSF is a community initiative

- Exemplars prove feasibility
- Profiles capture interoperability enablers
- Working for broader involvement

Contacts

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